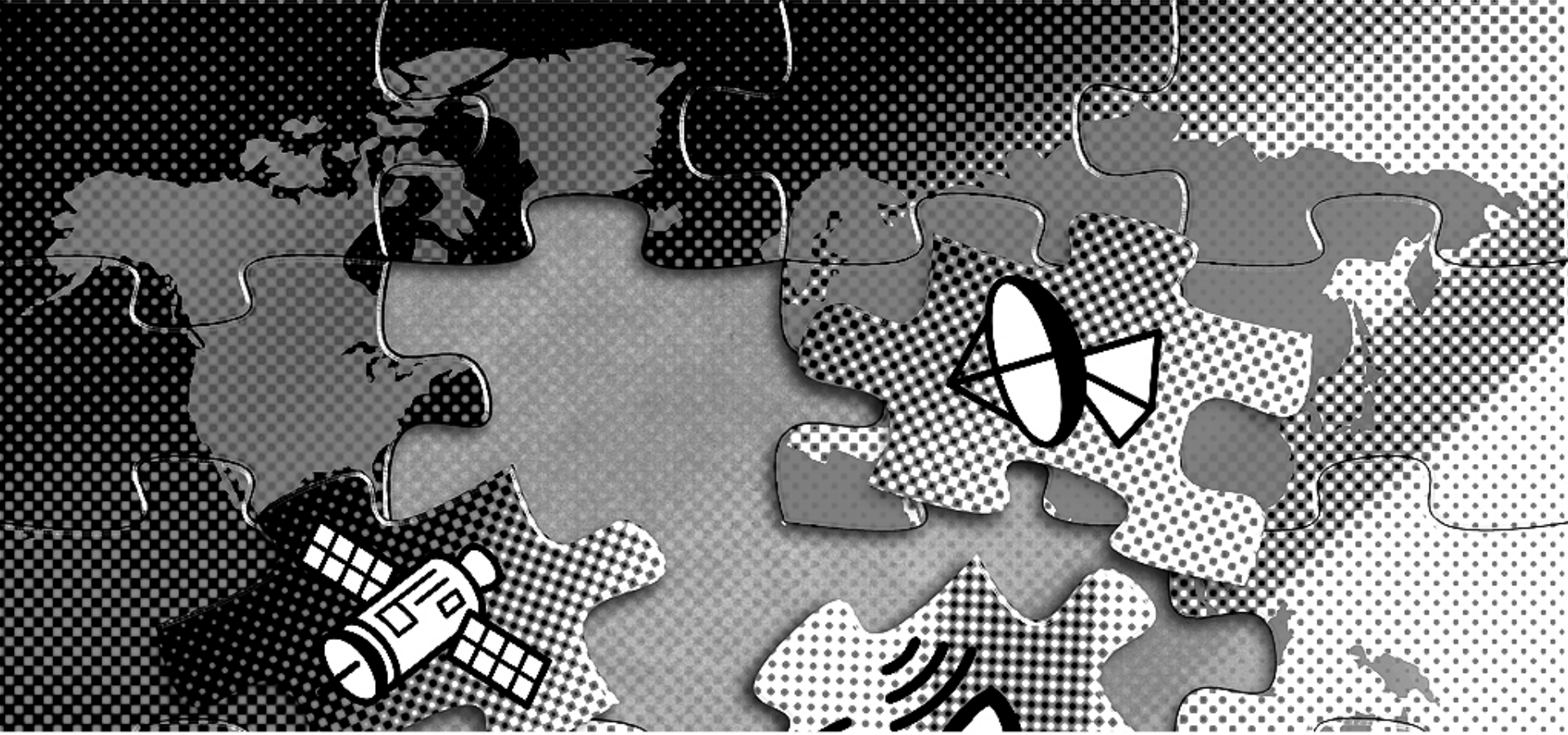


U.S. Ubiquitous Mobility Study – Briefing Call

U.S. Ubiquitous Mobility Study

Identification of, and Estimated Investments to Deploy Networks in, Un-served Areas

CostQuest Associates, Inc.

COSTQUEST ASSOCIATES

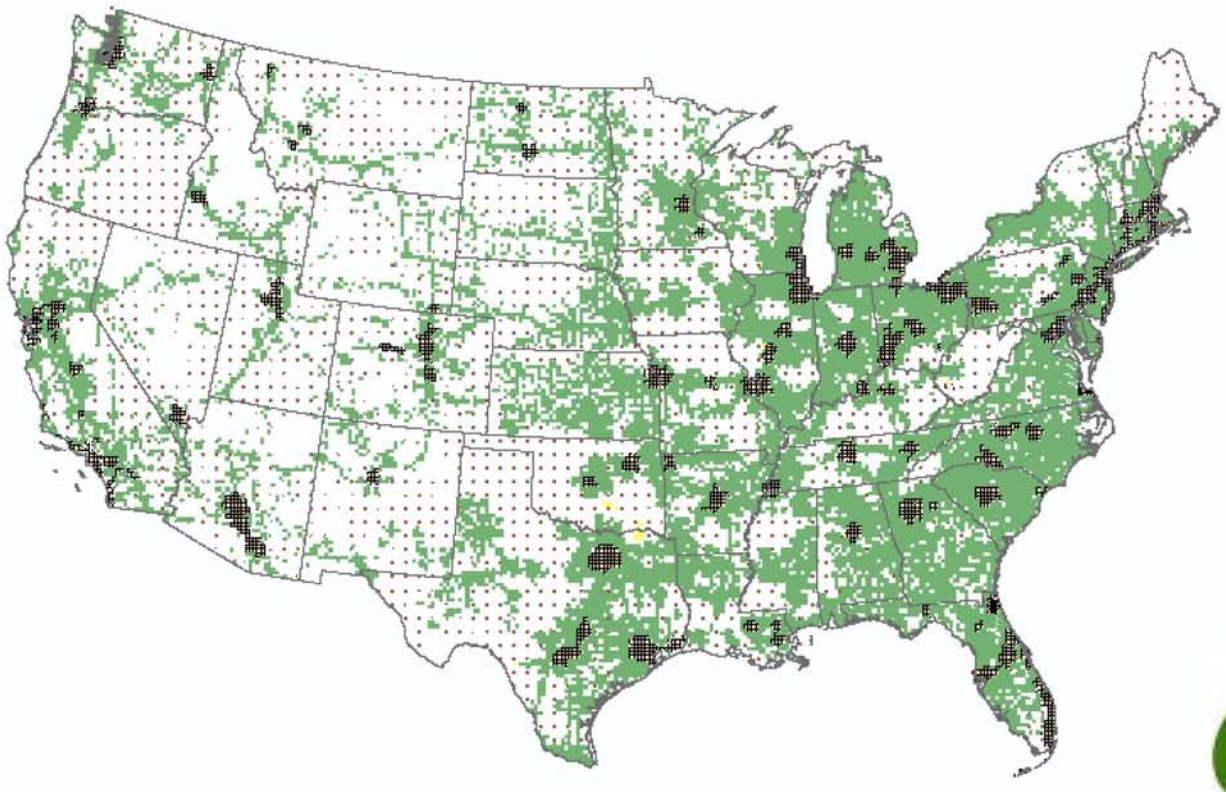
CQAmobile

U.S. Ubiquitous Mobility Study

GOAL: To study wireless coverage in the United States in order to

a) **Identify areas and population not served by wireless carriers for broadband (3G) services**

b) **Estimate the up-front deployment costs to build wireless broadband networks to these un-served areas**



COSTQUEST ASSOCIATES

U.S. Ubiquitous Mobility Study

Methodology – 6 Steps

1) Coverage Data Analysis

March 2008 coverage data (American Roamer)

2) Technology Isolation

Those areas served by each of the wireless technologies were isolated

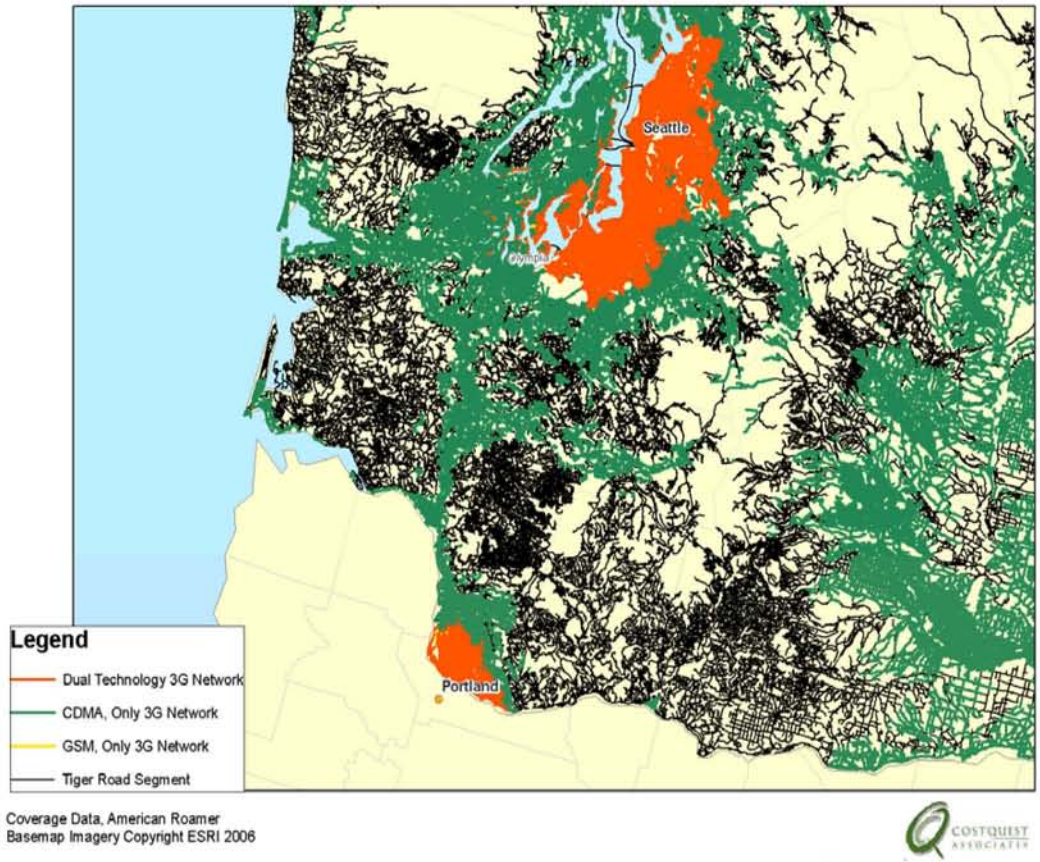
3) Asset Data Analysis

Existing wireless assets (tower locations) were overlaid

4) Road and Population Analysis

Road paths were the unit of analysis for coverage target for network build out and estimated coverage areas

Each road segment was identified by the technology served



COSTQUEST ASSOCIATES

U.S. Ubiquitous Mobility Study

Methodology – 6 Steps

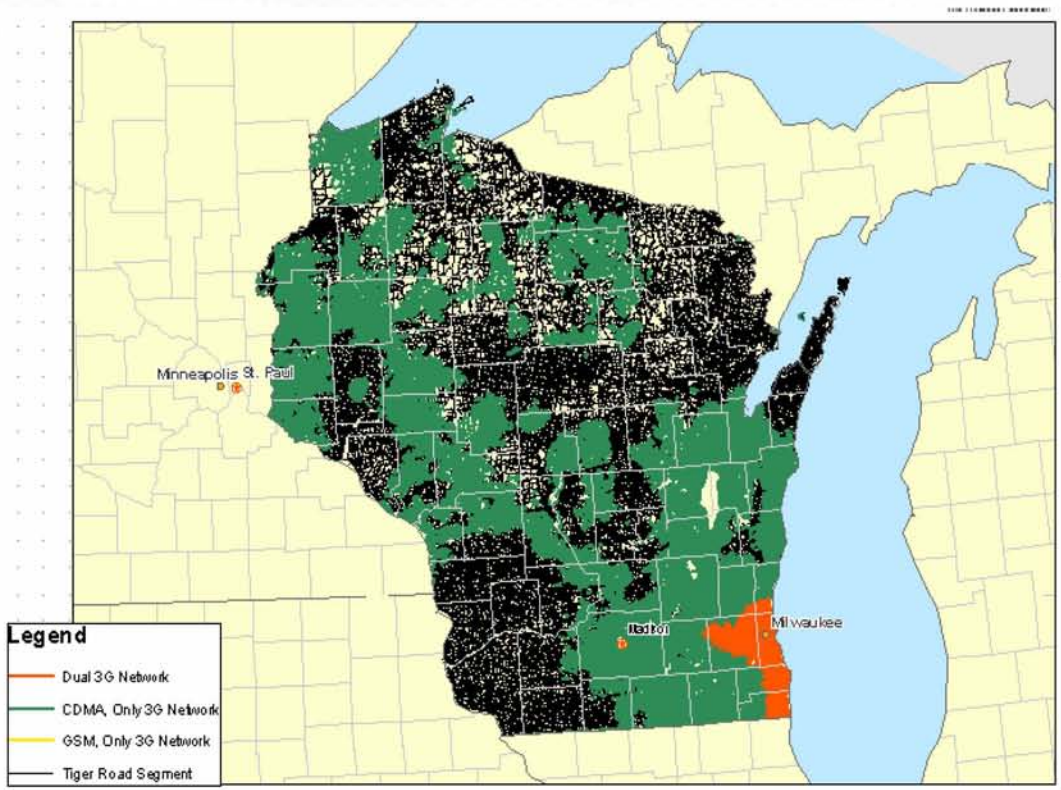
5) Coverage Analysis

The entire U.S. was divided into areas approximating the area that could be served by a single tower in lower density areas

6) Investment Development

Site counts were developed for both areas requiring augmentation and those areas requiring towers

Counts were multiplied by investment estimates, including factors for secondary investments



COSTQUEST ASSOCIATES

U.S. Ubiquitous Mobility Study

Methodology

Coverage Data Analysis - *Coverage Basis Determination*

In order to identify uncovered or unserved areas within the U.S., the study first identified the areas currently *covered* by various mobile wireless technologies

- Coverage for 3G services was derived from American Roamer's Coverage Right Advanced Services (2/2008) while the geographic extent of non-3G coverage was based upon American Roamer's Coverage Right (9/2007) data product
  - Commercial coverage database which has been introduced in several regulatory proceedings
- Coverage data was obtained for the top 5 wireless carriers by subscribership and 5 of the largest regional carriers
  - The carriers included in this study represent over 97% of the wireless market share and cover all 50 states, and the District of Columbia

U.S. Ubiquitous Mobility Study

Methodology

Technology Isolation - *Coverage Protocol and Generation Scenarios*

Given that both CDMA and GSM technologies are prevalent in the U.S. today and that the two platforms are not interoperable, coverage by the 3G evolution platforms for both types of technologies would be necessary in order for all consumers to obtain coverage in all areas

Mobile Wireless Generation Chart

Digital Ready Voice	**1G**		AMPS/Analog		
	2G	CDMA(IS95A/B)	TDMA (IS136)	GSM	iDEN
	2.5G	1XRTT (1X)		GPRS EDGE	WiDEN*
3G - Advanced Services	**3G**	CDMA2000/EvDO (EVDO Rev 0)		WCDMA/UMTS	
		EVDO Rev A		HSDPA	

*WiDEN is typically considered 2.5G technology, but WiDEN coverage areas are included in the CDMA 3G category for this study

COSTQUEST ASSOCIATES

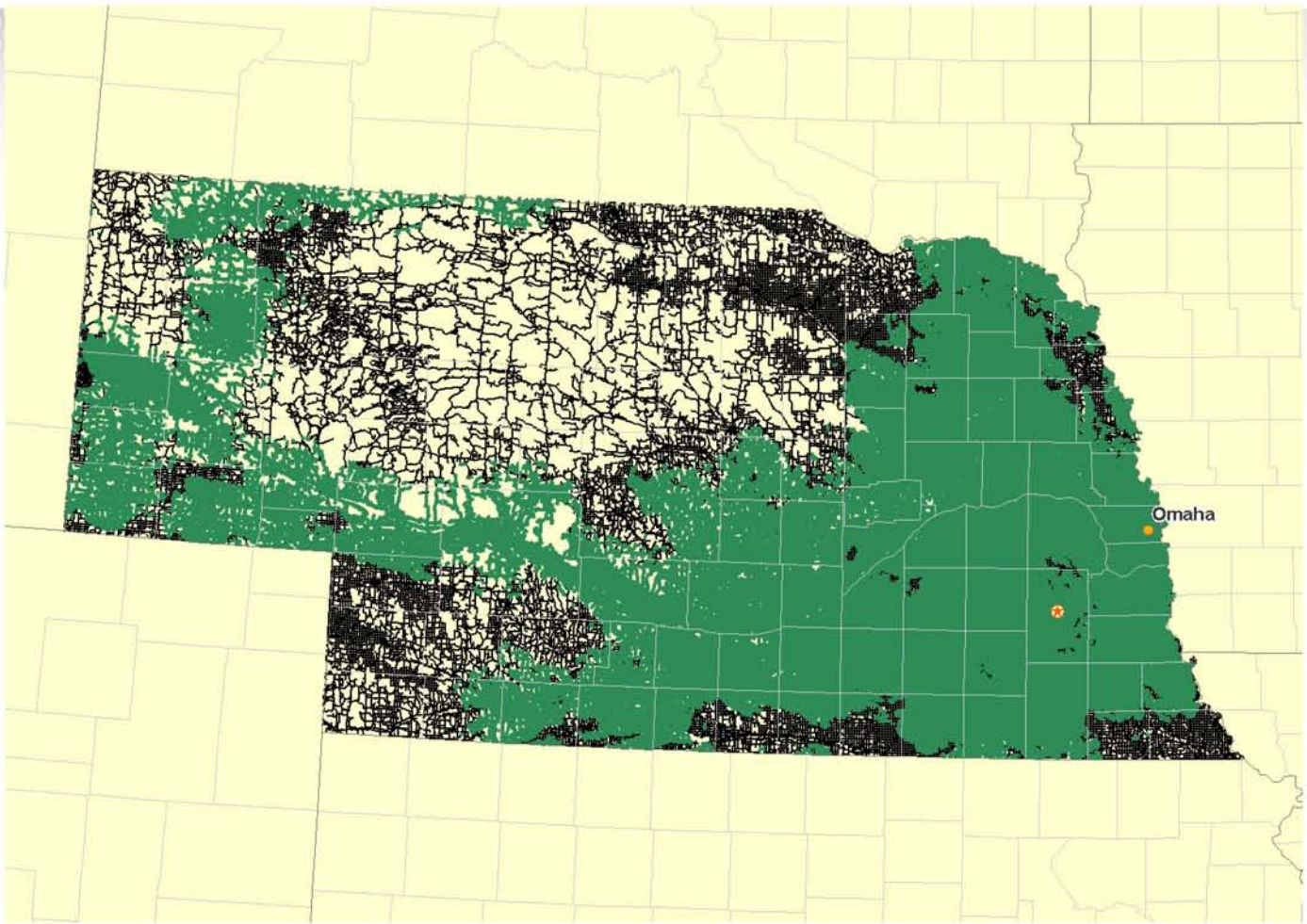
U.S. Ubiquitous Mobility Study

Methodology

Technology Isolation - *Coverage Protocol and Generation Scenarios* (cont'd)

- For those areas only receiving voice services, the study augments each serving area with appropriate investment to provide ubiquitous 3G coverage
- For those areas currently with no wireless service, the study augments each serving area with appropriate investment to build towers, antennas and backhaul to provide ubiquitous 3G coverage
- Finally, in those areas where only one 3G technology is deployed, the study augments these serving areas with the appropriate investment to provide both 3G technologies

U.S. Ubiquitous Mobility Study



Overlay of 3G Coverage Maps on Road Network - Green-3G, Black-Uncovered by 3G

U.S. Ubiquitous Mobility Study

Methodology

Road and Population Analysis - *Coverage Demand Identification*

Population

- While not a direct unit of analysis for the development of augmentation costs, population was studied to determine the counts of potential subscribers who are areas un-served by 3G
- Population data were derived from US Census 2000, SF1 population counts at the census block level
    - The population was then proportionally adjusted to the July 2006 county estimates
- Population was allocated based upon the amount of livable road side feet in that census block within each covered service territory

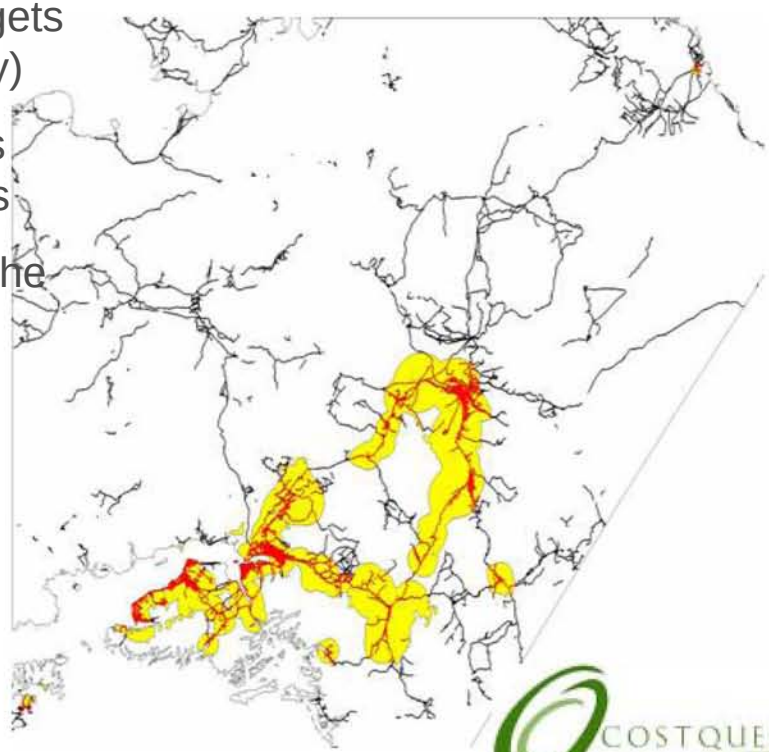
U.S. Ubiquitous Mobility Study

Methodology

Road and Population Analysis - *Coverage Demand Identification*

Roads

- TIGER 2006 First Edition roads were used as targets for where the population lives and travels (mobility)
  - Roads were also used to allocate the census population data into the appropriate grid cells
- Eligible road types were determined based upon the Census Feature Classification Code (CFCC)
  - Vehicular trails, forest service roads, Ferry Crossings and other special paths and trails were excluded from the study



COSTQUEST ASSOCIATES

U.S. Ubiquitous Mobility Study

Methodology

Road and Population Analysis - *Coverage Demand Identification*

Identifying Features of Interest

- This was accomplished by using a Geographic Information System (GIS)
- A geoprocessing model was used to identify road segments which were not covered by a 3G technology
    - The geoprocessing model effectively analyzed each eligible road segment and recorded the amount of that segment intersecting each 3G covered area

U.S. Ubiquitous Mobility Study

Methodology

Road and Population Analysis - *Coverage Demand Identification*

Identifying Features of Interest *(cont'd)*

- Using the geoprocessing model, five classes of eligible roads were developed
  - 1: All possible eligible road segments
  - 2: Roads covered by only voice technology
  - 3: Road segments covered by both a CDMA (EvDO) and GSM (HSDPA) class of 3G
  - 4: Road segments covered by only GSM (HSDPA) based 3G, and
  - 5: Road segments covered only by CDMA (EvDO) based 3G

U.S. Ubiquitous Mobility Study

Methodology

Coverage Analysis - *Cells and Coverage*

- A 6 mile serving radius was used to represent the reach of a tower site in lower density areas
  - This 6 mile serving radius equated to a 8.48 x 8.48 grid cell
- Once the road segments were classed by the served network technology, they were then classed within each cell
- The amount of road centerline feet covered by each network technology within a grid cell was then used to determine whether 3G augmentation would be required and the type of augmentation
  - In grid cells with road footage but no wireless coverage a single site, with full site deployment (e.g., tower, antenna, backhaul, etc.), was assumed sufficient to serve the entire cell

U.S. Ubiquitous Mobility Study

Methodology

Coverage Analysis - *Cells and Coverage (cont'd)*

- Grid cells covered by only voice based technologies (i.e., no current 3G deployment) were augmented with 3G upgrade equipment, rather than the equipment needed to fit out a full tower site
- In those grid cells where both technologies were deployed, no investment was necessary

U.S. Ubiquitous Mobility Study

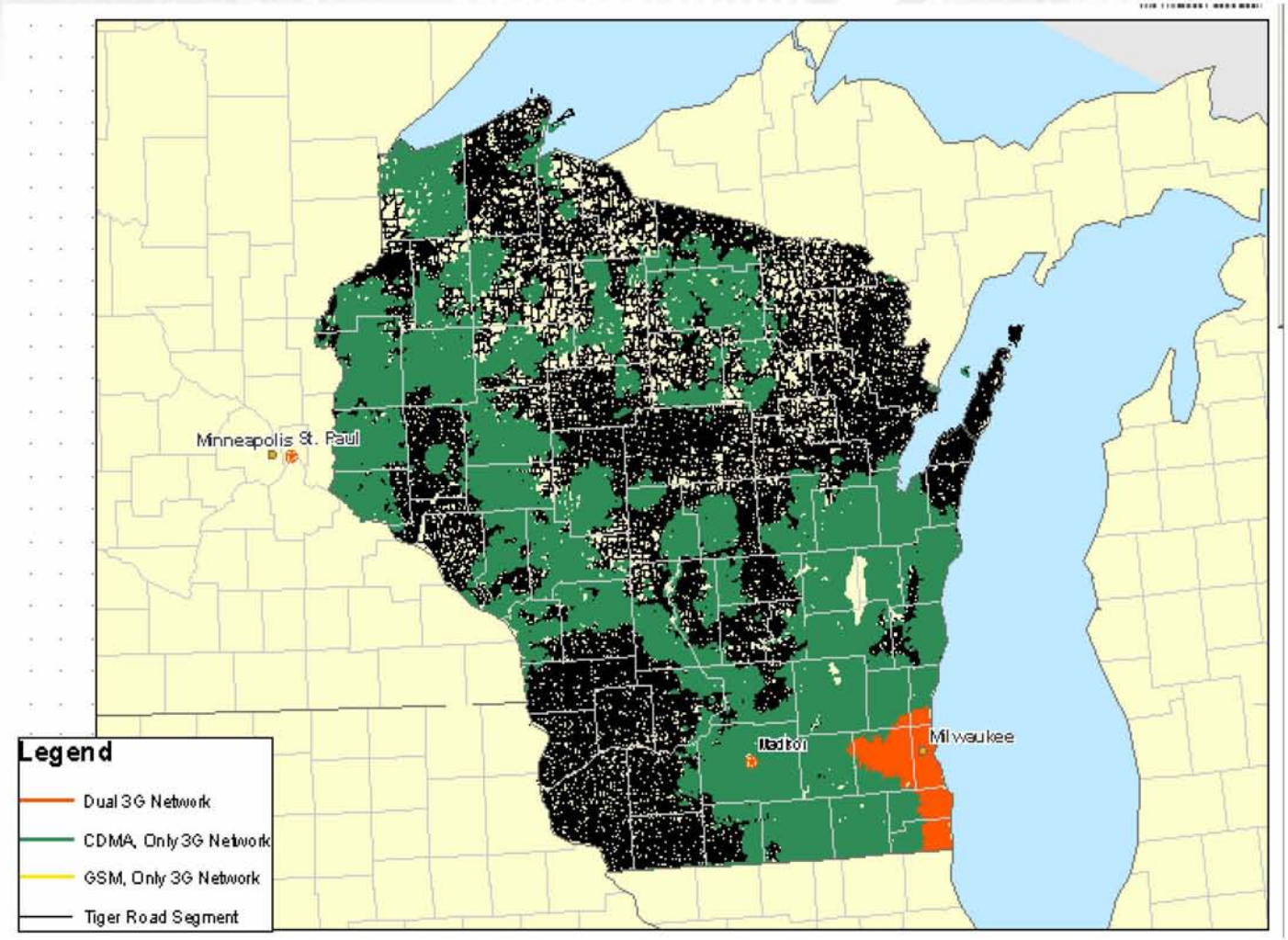
Methodology

Coverage Analysis - *Cells and Coverage (cont'd)*

- For cells within 3G served areas, existing tower sites were used as the augmentation target
  - In these underserved areas, the existing tower location information provides a better indicator of serving area engineering than does the 6mi tower radius used in un-served areas
  - Tower location information was obtained from Towersource.com
    - Broadcast towers were removed from this data set

U.S. Ubiquitous Mobility Study

Methodology



COSTQUEST ASSOCIATES

U.S. Ubiquitous Mobility Study

Methodology

Investment Development

This study was commissioned to identify only the initial capital investment of deploying ubiquitous wireless broadband coverage across the nation

- Based on the deployment requirements, full deployment or augmentation, the count of each type of deployment was then multiplied by the appropriate deployment costs, full deployment or augmentation

U.S. Ubiquitous Mobility Study

Methodology

Investment Development *(cont'd)*

- Counts:
  - For those areas already served by both a CDMA (EvDO) and GSM (HSDPA) based 3G technologies, no additional investment was needed
  - For those areas that are currently unserved by any wireless service, the grid cell analysis provided the total counts of tower sites that need to be fully deployed
  - For those areas where a tower exists but no 3G is provided, the grid cell analysis provided the total counts of tower sites that need to be augmented
  - For those areas where only one 3G technology is deployed, the existing tower count in the grid cell provides the basis for the count of tower sites that need to be augmented

U.S. Ubiquitous Mobility Study

Methodology

Investment Development (cont'd)

- Investment:
  - Tower/Site Cost Estimates
    - Full site deployment: cost estimated to be $650,000 per site for either CDMA/EvDO or GSM/HSDPA based 3G deployments and $865,000 for deployment of both technolgies
      - Includes the base station, tower, antenna, site acquisition, microwave backhaul, etc…
    - Augmentation: costs estimated to be $105,000 for GSM/HSDPA augmentation, $80,000 for CDMA/EvDO augmentation, and $185,000 for dual mode augmentation

U.S. Ubiquitous Mobility Study

Methodology

Investment Development (cont'd)

- Investment:
  - Costs used in the study were based on input from 4 wireless carriers
    - The cost inputs reflect the various buying power of providers, ranging in size from national carriers to smaller regional carriers
  - Estimates on secondary capital were also included in the study by multiplying the tower and augmentation costs by a factor (5%)
    - These secondary investments, which include switching, motor vehicles, furniture, tools, etc., only represents the secondary capital investment related to the initial build-out for unserved and underserved areas
  - Spectrum costs were not included in this study
    - The substantial costs associated with acquiring spectrum should be considered for further studies

U.S. Ubiquitous Mobility Study

Methodology

Investment Development (cont'd)

Up Front Capital Study Limitation

- This study does not estimate costs related to maintaining the networks or providing service
- Additional analysis would need to be performed to identify capital and operating costs related to maintenance, optimization (coverage and capacity adjustments for changing market conditions), and the general service and administrative costs associated with such networks

U.S. Ubiquitous Mobility Study

Summary of Findings

- We estimate that approximately **42% of road miles** in the United States do not have access to 3G mobile broadband service. This represents about **2.5 million miles** of roads.
- The estimated investment needed to build out infrastructure to facilitate mobile broadband service ubiquitously is approximately **$22 billion.**
- In order to achieve full 3G mobile broadband coverage, approximately **16,000 new towers** will need to be constructed and **55,000 existing towers** will need to be augmented with 3G technologies.

COSTQUEST ASSOCIATES

U.S. Ubiquitous Mobility Study

Summary of Findings

- Nearly a third of the investment necessary for bringing 3G broadband ubiquity to the U.S. is for augmentation of existing site locations.
- States with lower population density require more new site investment rather than augmentation of existing network assets. More than 90% of the estimated investment for Alaska, Idaho, Montana, Nevada, and Wyoming is Greenfield or new site investment.
- Ten states represent nearly 50% of the estimated investment needed for ubiquitous 3G wireless service in the U.S.

COSTQUEST ASSOCIATES

Un-served Areas

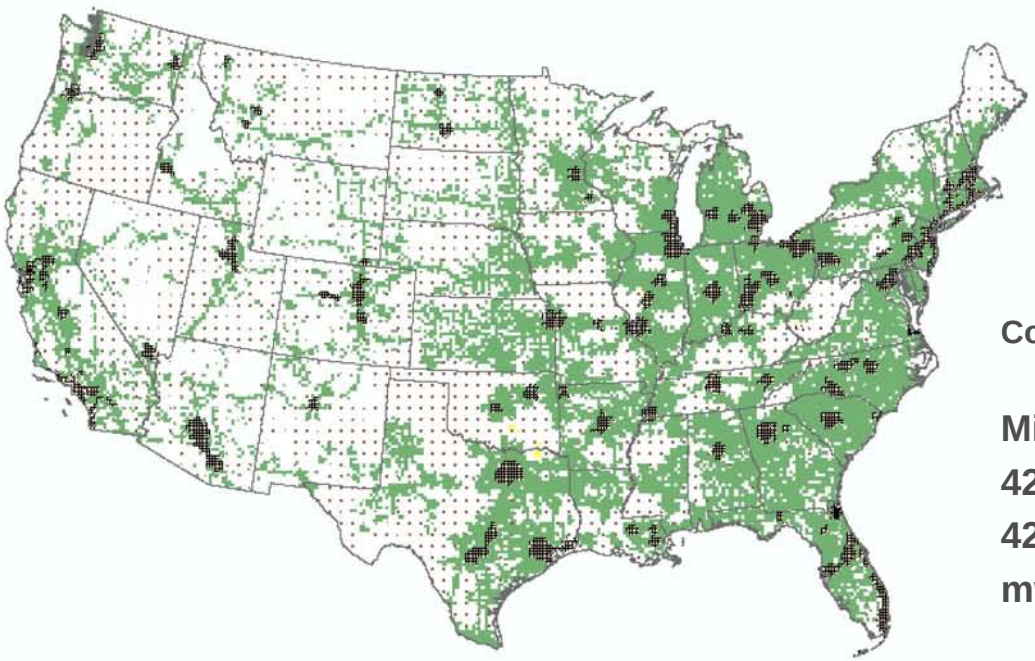
State	Population Unserved by Mobile 3G	Percent Road Miles Unserved by Mobile 3G	Percent Geographic Area Unserved by Mobile 3G
Alabama	535,125	21%	30%
Alaska	315,189	87%	98%
Arizona	214,013	62%	80%
Arkansas	225,894	27%	35%
California	715,985	36%	61%
Colorado	258,632	59%	76%
Connecticut	87,180	3%	5%
Delaware	7,438	2%	6%
District of Columbia	-	0%	0%
Florida	198,026	8%	22%
Georgia	334,086	15%	21%
Hawaii	128,830	27%	57%
Idaho	132,337	67%	83%
Illinois	705,239	22%	29%
Indiana	546,519	13%	16%
Iowa	1,082,406	59%	63%
Kansas	169,390	38%	45%
Kentucky	1,318,302	53%	60%
Louisiana	725,254	31%	44%
Maine	467,162	65%	83%
Maryland	229,120	10%	18%
Massachusetts	123,016	5%	10%
Michigan	404,429	21%	58%
Minnesota	777,478	53%	67%
Mississippi	887,855	47%	50%
Missouri	993,593	45%	56%
Montana	185,195	82%	90%
Nebraska	149,068	47%	65%
Nevada	61,956	76%	90%
New Hampshire	295,936	23%	39%
New Jersey	90,975	1%	3%
New Mexico	260,473	74%	86%
New York	978,061	24%	44%
North Carolina	523,997	15%	20%
North Dakota	88,808	66%	71%
Ohio	578,357	11%	21%
Oklahoma	1,101,262	66%	73%
Oregon	537,055	74%	86%
Pennsylvania	1,354,928	25%	36%
Rhode Island	14,234	1%	1%
South Carolina	42,678	3%	5%
South Dakota	82,086	64%	76%
Tennessee	840,015	28%	37%
Texas	1,427,567	46%	59%
Utah	47,821	66%	84%
Vermont	112,006	52%	60%
Virginia	421,832	16%	22%
Washington	285,138	47%	65%
West Virginia	1,083,017	77%	84%
Wisconsin	912,652	41%	58%
Wyoming	96,006	80%	86%
Total	**23,153,618**	**42%**	**68%**

Investment

State	Est. Count of New Sites	Est. Count of Augmentation of Existing Sites		Est. Investment
Alabama	130	2,068	$	351,445,500
Alaska	1,678	440	$	1,602,373,500
Arizona	913	640	$	919,842,000
Arkansas	176	1,151	$	291,201,750
California	769	2,182	$	975,969,750
Colorado	815	620	$	821,598,750
Connecticut	4	201	$	25,793,250
Delaware	3	110	$	14,852,250
District of Columbia	-	-	$	-
Florida	151	2,010	$	361,100,250
Georgia	135	2,467	$	396,448,500
Hawaii	51	135	$	63,388,500
Idaho	726	473	$	720,189,750
Illinois	87	1,565	$	260,442,000
Indiana	52	1,477	$	211,664,250
Iowa	103	1,282	$	263,282,250
Kansas	327	1,355	$	457,558,500
Kentucky	117	791	$	209,013,000
Louisiana	94	1,543	$	267,671,250
Maine	151	542	$	216,305,250
Maryland	18	411	$	62,921,250
Massachusetts	19	282	$	48,683,250
Michigan	187	1,762	$	377,711,250
Minnesota	341	1,211	$	473,550,000
Mississippi	125	1,348	$	276,512,250
Missouri	147	1,484	$	324,350,250
Montana	1,252	691	$	1,245,147,750
Nebraska	344	1,113	$	457,742,250
Nevada	1,012	463	$	986,658,750
New Hampshire	31	264	$	58,605,750
New Jersey	10	265	$	38,298,750
New Mexico	890	824	$	934,048,500
New York	205	1,555	$	363,090,000
North Carolina	107	2,007	$	321,226,500
North Dakota	509	498	$	528,207,750
Ohio	50	1,557	$	220,095,750
Oklahoma	121	1,260	$	290,865,750
Oregon	373	1,159	$	522,501,000
Pennsylvania	148	1,427	$	295,695,750
Rhode Island	1	7	$	1,680,000
South Carolina	26	1,801	$	222,174,750
South Dakota	553	541	$	575,851,500
Tennessee	94	1,374	$	244,823,250
Texas	930	5,719	$	1,567,933,500
Utah	626	476	$	639,103,500
Vermont	66	85	$	69,987,750
Virginia	105	1,609	$	274,018,500
Washington	387	937	$	468,825,000
West Virginia	142	387	$	180,180,000
Wisconsin	171	1,314	$	317,651,250
Wyoming	929	309	$	882,703,500
Total	**16,413**	**55,275**	**$**	**21,721,680,750**

U.S. Ubiquitous Mobility Study

COSTQUEST ASSOCIATES



Contact

Mike Wilson
425-256-2154 (office)
425-772-2261 (cell)
mwilson@costquest.com